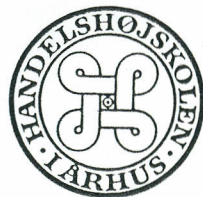




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435

The Ecological Approach to Diagnosis of Service Information Behaviour

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This paper presents a new approach to analysing verbal behaviour. Underlying this approach is a subject-governed model, which means that a text producer (agent) is the reference point in coding. The study through which the method is exemplified originates from a survey of mechanics carried out by a Swedish multinational machine industry. The results illustrate how workers in various cultural contexts value information of relevance to their job performance. Despite their common language, English and US mechanics diverge in their subjective consciousness.

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The classical research design of the behavioural scientist requires an ability of the subjects in his studies to discriminate between right and wrong. The subject in question gets the task to learn a set of stimuli while the experimenter or some other external source determines the correct behaviour. Thus the classical procedure in the study of behaviour builds on the following model for positive reinforcement (Sundel & Stone Sundel, 1975):

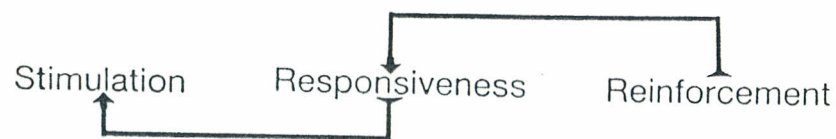


Figure 1. Positive Reinforcement Model

By using this model (Fig. 1) it can be demonstrated (Bateson, 1979) that a subject has been able to successfully learn to discriminate by choosing the correct stimulus or showing the correct behaviour. A correct behaviour reinforces the propositions and rules of the behavioural scientist. After all, the reinforcement reinforces the response. The model has been used successfully to study the discriminative ability of animals, children, and adults, which is determined by measures of similarity. On the other hand, the model cannot provide any information by which it is possible to determine whether the subject is conscious about its behaviour. Thus we are not able to find out whether the subject has developed its own concepts.

The subjects personal system of concepts is the key to his consciousness about his own behaviour. Consciousness, especially self-consciousness, has during the last decade been studied in particular by Sperry, Zaidel & Zaidel, 1979; Sperry, 1983). There seems to be an articulated interest today in cognitive processes the way they relate to economic settings. While classical economic theory assumes that the principle of choice guarantees models which generate value free sets of data, it may be more important for management to get hold of the employee's subjective con-

sciousness of reality and need for information in his work. Subjective consciousness refers to the experience of the individual's own mental activities as unity. This unity is exclusively expressed in natural language. Further, through reference to "I" it is possible to give verbal expression to alternative actions and consequences. Thus subjective consciousness is intimately related to the individual's conception of how he can make a living, which means that justice and morality are included.

The Ecological Approach

The ecological approach to a diagnosis of service information behaviour comprises some fascinating intertwined logics, one related to the structure of verbal behaviour (text), and the other to its form and organization. In this section, I will first give a description of the mechanism that governs the intentional use of language and later on follow up its implications by means of an empirical text analysis. This section will be the basis for the following discussion.

Observing behaviour in individuals acting purposely in a meaningful environment is hardly possible without a conceptual analysis. The possibility of representing observations prerequisites the distinguishing of an agent and an objective of an action. A paradigmatisation of this requirement into the

Agent → action → Objective

(1)

schema imposes a constitutive function on the context. Distinctive of the ecological approach to an analysis of text is its foundation in the following assumptions:

1. Text is an expression of an agent's (A) interactions (a) with some environment (O).
2. The experience of the agent builds on actions which incorporate both intention and orientation, implying both to be integrated in the verbal flow.

With these two points of departure the central theme for this

presentation will be the assumption that an organism being able to express itself freely creates information of high validity. The bearing idea underlying this assumption is that behaviour characterized by regularity leads to symbolic expressions. Shall they have meaning at the ecological level of analysis, we are required to be able to distinguish between activities belonging to action and observation respectively. Further, the teleonomic component (Monod, 1971) of behaviour concerns the preservation of experience, and the organism's ability to structure and transform its environment. The general cooperation of the organism with its environment requires the teleonomic concept in order for the organism to express an "intended" and "oriented" schematization. There are good reasons to believe that the original language communication has been verbal and not nominal (Jaynes, 1976). If so, an ecological orientation in language analysis should bring knowledge about the use of symbols in the observation process.

The Architectural Configuration of Cooperative Action

The structure embedded in formula (1) may be visualized as a complementary arrangement of its components in a three-dimensional space. The process anticipated to operate in this structure may be halted or started at any moment. This may be done by fixating or mobilizing its action component (a). The manipulation of this component manifests itself through a binding of numerical values to the A and O component respectively. In the present context it may be sufficient to assume a finite set of values $[0,1]$ reflecting the case of nominal or linear variables. Binding these values with respect to the complementary roles of A and O initiates a nominalization process by which abstractions can be processed to prove structural affinity.

The definition of affinity between agent and objective (1) is obtained through the function of the verb. Whenever a verb relates an agent with an objective, affinity is marked with the value one (1), otherwise zero (0). A first step in the process requires the set up of a series of matrices of the $N \times n$ type. These are the conditions which shall enable us to detect trans-

formations and regularities in change. If we are able to discover natural groupings of the Agents as well as the Objective to which we can give meaningful names, it would imply that we can give a sensible and precise meaning to the structure of a text.

The matrix construction begins with a representation of text according to the example of text formatting given in Table 1. The procedural processing of running text in Table 1 illustrates that every textual element gets its unique code assigned to it. The first figure in the code addresses dynamic properties, while the second one represents descriptive, i.e. more static information. Every 30 code with the boundaries of a 01 or 00 code makes up the rows of a matrix, while all 50 codes constitute the columns of that matrix. Consequently, every realization of a structural relation can be distinguished and counted. A consequence of formula (1) in the matrix generation is that a not explicitly stated Agent implies an X-variable, while an absent Objective implies an Y-variable.

A computer program, "Text Editing and Cluster Analysis for

Table 1. Formatting of text

Text Data	Code	Text Data	Code
.	00	information	50
[att]	01	[att]	01
I	30	(too)	51
do	40	(much)	52
n't	50	(information)	50
[att]	01	is	40
(I)	30	sent	40
think	40	out	50
too	51	(x)	30
much	52	.	00

Note: The rules for processing of the scheme for formatting are given in Bierschenk & Bierschenk (1986, a,b).

Perspective Text Analysis" (Helmersson, 1987), builds up the matrices as input for cluster analysis. This method is especially suited when we can assume affinity instead of the usual independence. A variety of grouping methods of a data set can be executed according to various principles. The principles of relevance are partly a successive agglomeration of elements, partly the definition of an optimization criterion for governing the grouping process. The mechanics of the analysis permit the discovery of coordinative structures of the Agents, which is a prerequisite for discovering the perspective in the verbal flow. Further, the relation between grouped Objectives can be discovered, which means that we can state the coordinative structures of the viewpoints.

The basic premise on which all scientific observation rests is that processes can be isolated and studied with respect to their structural stability. It was stated (1) that prototypical forms are observable and that any subjective consciousness that can be formalized into an expression such as

(A a (A a O, A a O, ...))

(2)

states that prototypical forms are recurrent. The formulas (1 and 2) indicate transference, which means that the A a O's of the text cooperate in order to lift the information from its syntactic carriers. This requires the modelling of the A a O's such that they can be formalized with respect to the following basic components:

- Agent: denotes an action center, i.e. the point of reference for an observation. It is the intentional and thus most basic component without which no action can whether occur nor be controlled
- Action: denotes the intentional character of an observation expressed. Thus the action is instrumental for the Agent in coordinating the observations.
- Objective: denotes the final point for the action and has the following subcomponents:

- Figure: denotes the point of intention
- Ground: denotes the point of orientation
- Means: denotes the instrument of an observation
- Setpoint: denotes the limit of an observation

Intention and orientation are thus combined in every meaningful behaviour, that is, the organism's interaction with its environment requires the ability to express both behaviourally. Therefore, the action level always denotes a specification of the environment, that is, a context.

Textual transformations and changes in the presentation of observations on the one hand are abstract phenomena, but they are still the prerequisites for a detection of the structural nature of the observations. The relation of the structure to the entire text, on the other hand, is of a multivariate kind and thus too complex to comprehend other than by means of some graphical device. As will be demonstrated, a depiction of this structure brings out information about the teleonomic component.

Experiment

Method

Of particular significance for a cognitive approach is the model's capacity of reflecting direct perception as it has been represented by James J Gibson (1979). In short, direct perception means that what humans perceive from objects and events in their environment is not their single features, but instead functions of higher order, that is, invariant structure. Information or meaning is the special value that the objects or events mediate in the moment of perception. In the following, the representation of invariant structure will be exemplified with reference to the texts of English and US workers of a multinational machine industry.

Subjects

A Swedish multinational industry with companies in various geographical areas of Europe and overseas has carried out an extensive survey. Their goal population amounts to about 30-40 thousand persons. The accessible population was estimated to

about 12-15 thousand mechanics. From this population about 4-5 thousand individuals were selected by the representatives of the companies.

Materials

The three open ended questions posed to the workers have been translated by the industry into various languages. The English version will be given here:

- Question 1. Do you have any ideas/suggestions how to encourage more mechanics to use the service manuals?
- Question 2. Do you have any suggestion how getting information to you can be improved?
- Question 3. Do you think too much (or too little) paper (information) is sent out?

These questions highlight different aspects of import to the management and selective dissemination of information. To counterbalance the variations in translation, they have been treated as if one question was posed. Some authentic responses will now be reproduced to give the reader an impression of the kind of text analyzed.

English text. "Far too much sent out. Judging by the amount of bulletins sent out on the [A model] I would suspect that it was not properly developed." (Response to question 3.)

United States Text. "I don't think too much paper information can ever be provided. For most of the technicians this is probably the only method by which they may stay informed." (Response to question 3.)

The attributes of the materials are usually considered of great importance for the definition of what is informative for processing. Especially with artificially defined materials, experimenters are very careful in reporting the surface features, because these seem to be of import for their formulation and generation of knowledge. In our case, the surface features are comparatively unimportant, because we are working with a naturally produced text. Such a text is characterized by a structure existing beyond what can be composed or computed by organizational connections.

Design and Procedure

The experimental variable of interest in the present context is culture. The material was divided up into the following cultural contexts: Sweden, England, West Germany, Italy, and the United States. It turned out that only seven Swedish subjects have produced useful unrestricted verbal responses. Therefore, seven subjects were randomly selected from the other areas to match the Swedish sample.

Results

When an analysis of the experimental texts takes its point of departure in the schema model (formulas 1 and 2), a strict dependency between textual elements becomes visible. Among the procedures available, Ward's (1963) method seems to be sufficiently reliable for binary data. The computational procedure to synthesize the successive segments in a progressive development of a text has been executed with Wishart's (1982) CLUSTAN program. A full account of all the analyses carried out is given in Bierschenk & Bierschenk (1987). The following account of results is extracted from this report.

Presumably, different Agents have different functions in a text and have been chosen to give expression to what is subjectively conscious. A differential typological analysis of the Agent function can give information about which processes may be thought to operate in the manifestation of the cultural influence on consciousness.

Any hierarchic grouping procedure produces dendrogram data. These can be represented in the form of a tree. But first when a topographic presentation of the outcome of a cluster analysis is attempted it will give new insight into the dynamics of the text. This type of representation is especially appropriate for the study of text whose underlying dynamics is not known. Further, a cubic space representation (see Fig. 2) is also suitable in situations in which the only reliable observations are discontinuities or singularities (Saunders, 1980, p 1). Because of the foundation of singularities in topology it means that this pro-

perty of a point is called invariant.

The cognitive process of the English workers and the structural relations contained in the English text are presented in Figure 2. The background of the cube takes up the Figure component. At the base of the cube the relations pertaining to the Ground component are visualized. The foreground represents the perspective on the Figure. The description will begin with the Figure component.

The edges of the planes represent the terminal states of the processes. The process of the Figure component starts in the state of Model Criticism. It basically addresses the criteria for the evaluation of the functional fitness of the Service Support unit of the multinational industry. Such criteria could be

- (1) Significance: denoting the preciseness and validness of the information with respect to the addressee's actual problems.
- (2) Exactitude: asking for information that describes an innovation or modification reliably.
- (3) Influence: requiring information that to a certain degree has impact on a particular worker's motivation and actions.

This state becomes transformed by Lack of Information, which addresses the extent to which disseminated information is structured to meet the information needs of a particular person or group. The result of this transaction is the first singularity, named Preparedness Restrictions. At this point, it becomes obvious that the workers seems to experience a vague or ill-defined conception of how to go about in finding a problem solution. It may also mean that they are searching for too much information or that they have acquired a habit of restricting their behaviour in such a way that the problem is conceived to be unsolvable.

The process transits in a next step into the state of Embarrassment, meaning a state related to the valuation of what can be performed and what cannot. This step produces Infeasibility. At this point a mental state is reached, which can be conceived as a conceptualized barrier towards carrying out service functions. From here the process transits through the state of Overabundance. This state indicates that required selection processes do not function as expected. The resulting singularity is Dis-

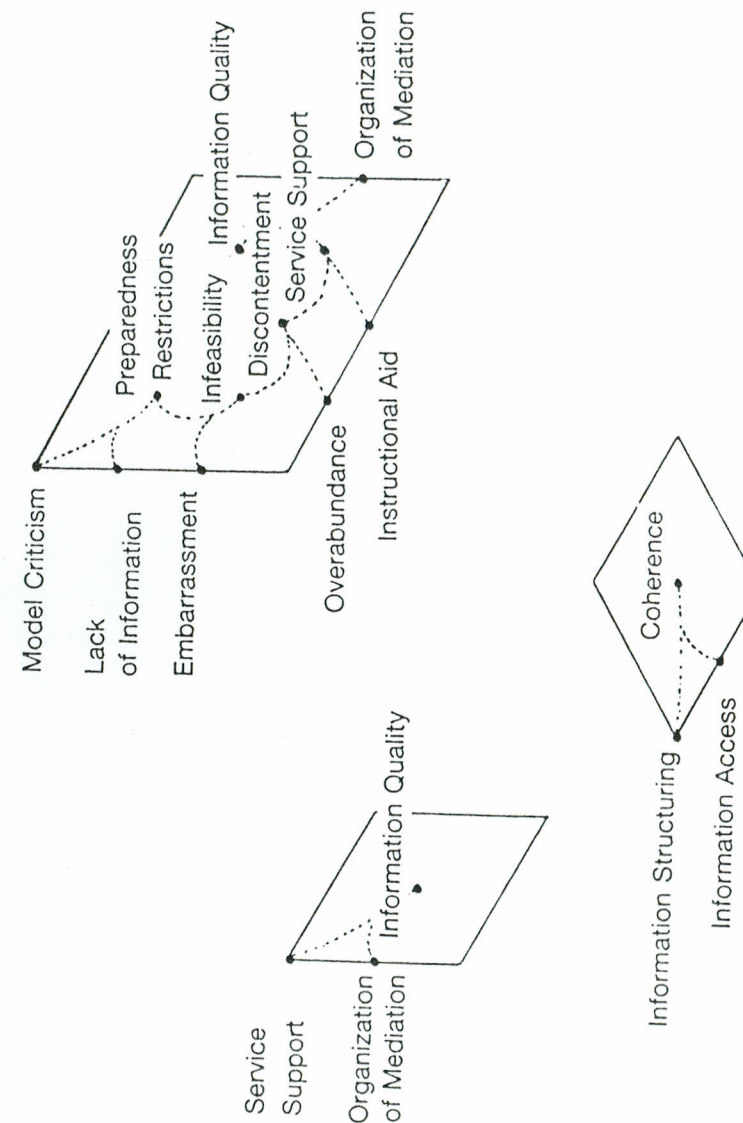


Figure 2. Operating structural relations characterizing perspective and viewpoints of English mechanics.

contentment. The stress at this point of the produced curve is on a feeling of resentment towards the company.

The process now leads to a transit through the state of Instructional Aid, which puts a heavy load on the personnel with the task to give Service Support. Service Support is the singularity which marks the import of determining the kind of information needed in carrying out particular tasks for specified purposes.

The final transition refers to the state of Organization of Mediation and results in the highest point of the curve, called Information Quality. Therefore it can finally be stated that Service Support means the creation of information that necessitates continually ongoing retransformation processes which are prone to distortion.

Thus the root of the mental process depicted seems to concern a questionable quality of the information disseminated. This circumstance is further enhanced through the perspective on the Figure. Its focus is on Information Quality.

The Ground component is defined by two terminal states, Information Structuring and Information Access, leading to the singularity of Coherence. Information Structuring requires that the personal concepts of the information user be used in information management. Information Access refers to the time interval between requests for information and its availability. Coherence is the only singularity in the Ground and refers to the problem of judging the relevance and meaningfulness of the information provided through the system's performance.

Conclusions. The English workers are from a topical point of view mainly concerned with (1) inefficiency of the Service Support unit of the company and (2) insufficient quality of the information provided. From a cognitive or mental point of view, their stress lies on the interface between the information provider and the user.

After the observations of the structural relationships characteristic of English mechanics in relation to the question of job related information, it would be of interest to study the

subjective consciousness of their United States counterpart. This comparison may be of interest because both speak one and the same language and thus may give an indication of how culture influences the workers' way of seeing reality. The discussion of the operating structural relations in the US material will proceed in the same way as before. The only new information to be added for the understanding of Figure 3 relates to the Means component. It is represented in the upper left part of the left hand side.

The cognitive process depicted in the background starts in the terminal state of Declination. The import of this state is that the amount of information delivered has been exposed to various forms of destructive tendencies. For example, the steering and controlling mechanism is conceived to be producing too much redundancy or failure in addressing the individual worker or in regulating the information fed back by the worker. Then Declination follows, which implies an information system whose functions are too clumsy to make possible a differentiated growth of information.

Personalization is the next state through which the process transits. The indication here is that humans like to be informed by humans. This type of information is perceived as being of considerable help. So this state transforms Declination into Enablement. From here the process leaps into Coordination, meaning that a particular person functions as a selector and instructor. If information is structured in such a way that interpersonal relations become used, it is conceived as the best information one can get. Especially novel information requires that the worker gets clear-cut instructions on how to treat it. The process now develops into Constructiveness, a concept expressing a behaviour that involves the utilization of materials and tools in serving to be helpful. The state of Information Access transforms Constructiveness into Cognitive Operation. This is the ultimate mood for the conscious reformation of one's own abilities. Reasonableness directs attention to the consciousness developed by the workers and the mental activities they have experienced.

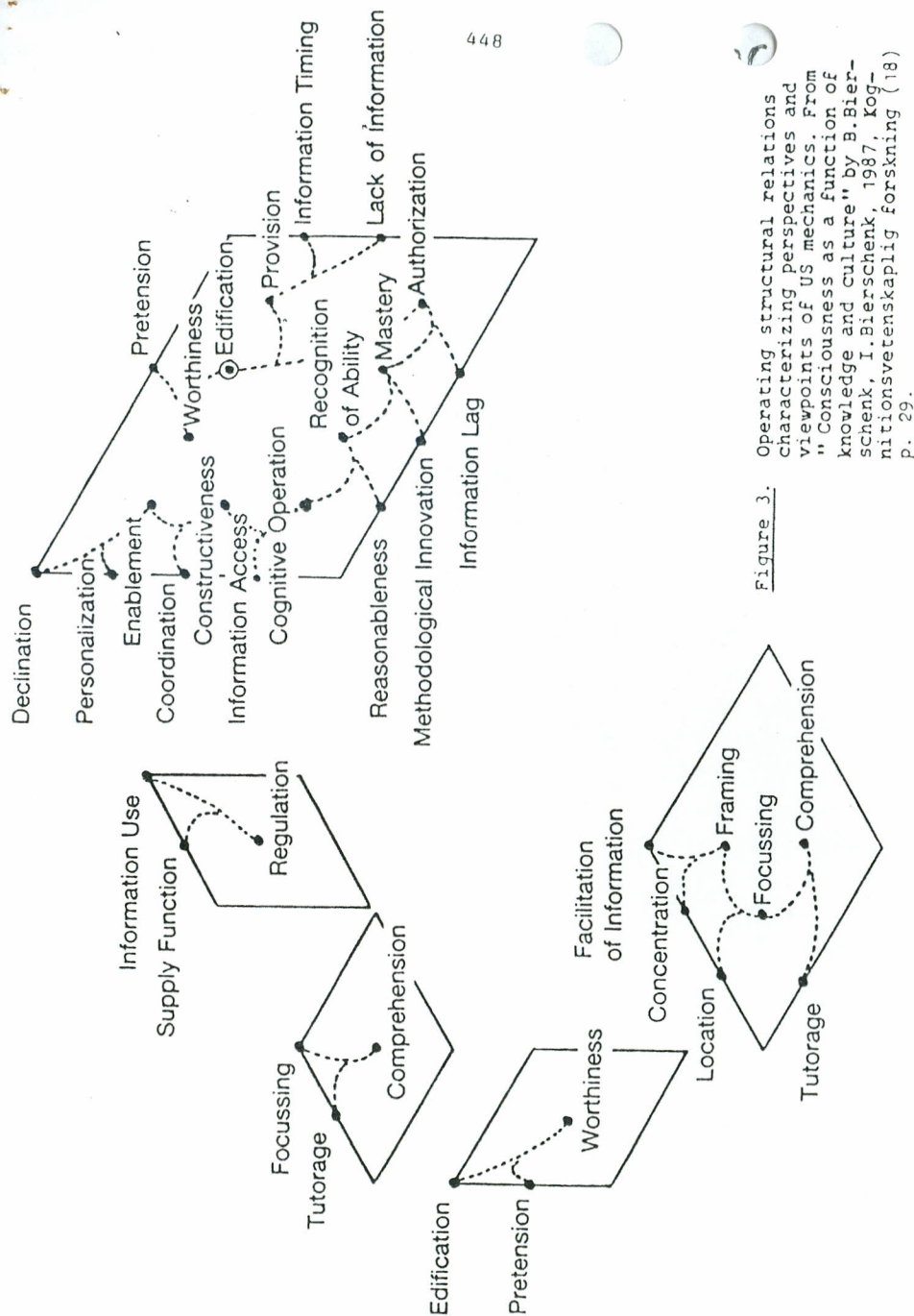


Figure 3.

Operating structural relations characterizing perspectives and viewpoints of US mechanics. From "Consciousness as a function of knowledge and culture" by B. Bierschenk, 1987, Kognitionsvetenskaplig forskning (18) p. 29.

When the process transits through this state, it develops into Recognition of Ability. This singularity denotes a desire to pay attention to the consequences of the way in which information is disseminated. As a consequence, devices have to be developed for an unbiased assessment of the workers' abilities. Otherwise misunderstanding and misinterpretation may result and render the company incoherent or even incomprehensible. However, through Methodological Innovation, this state can be transformed into Mastery. On the other hand, the workers seem to show estrangement because of Information Lag, which transforms Mastery into an insufficient Authorization. Thus at the highest point of the first cycle in the graph, the workers give expression to an interference with their possible achievement, which is an unsatisfactory state from their point of view.

From here the process continues into the first state of the second cycle, namely Lack of Information. An overabundance of information without any novelty tends to be conceived as missing. At the next step, the process reaches Information Timing, a state that may be regarded as a positive and compensatory regulation of this "system error", resulting in Provision. This is also the peak of the second cycle. This cycle crosses the path of the first one with the effect of a deepening of the mental structure, indicated by a circle around the node named Edification. This concept may be conceived as a necessary means for increasing the subjective consciousness of the workers to facilitate an inner-directed change of their behaviour, instead of an outer-directed (speak company-directed) by behavioural modification. The process finally transits through the state of Pretension, which is determined by the ratio of actual behaviour to supposed behavioural potential. The transformation taking place results in the highest point of the entire curve, that is, Worthiness. Thus a conception of merit and respect has emerged as the root of the mental structure of the US mechanics.

This point is lifted up and focussed upon in the perspective on the Figure.

The transformational process depicted in the Ground is more

elaborated than in the previous Ground. The process has one cycle, which shows a thematic development on efficient information management as foundation for competence development. The states defining the edges of the Ground, Facilitation of Information and Concentration, indicate that infrastructures may develop that require a certain Framing of information. Their Location implies that information is organized in a manner which appears alien to the workers. Only by developing integrating and interacting mechanisms a Focussing on required information will be possible. For these workers the only way out of this state is provided through the function of Tutorage, which transforms Focussing into Comprehension.

The perspective on the Ground lifts up and accentuates the highest point of this curve, namely Comprehension.

The Means component, finally, shows Information Use as the initial state. It indicates the importance of information in the comprehension process. The state of Supply Function transforms Information Use into Regulation, thus expressing a need for putting values on the presentation of information.

Conclusions. The textual transformations abstracted from the US material give expression to a willingness in solving service problems. On the other hand, the workers indicate that their ability is insufficiently recognized. Moreover, they bring out a self-consciousness in that service information is of concern for them. It is considered a necessity and as such an integrative part of their everyday life. They relate the challenge they experience directly to their worthiness.

Discussion

The analyses presented in this paper show that the concept of consciousness can uniquely be defined by the development of a topic or theme. It has also been shown that the coordinative structures are modulated by information coming from the context, that is, various cultural sources. By keeping the perspective structure separated from the objective, the method used has demonstrated textual transformations in the form of a cubic space.

The topographic representation gives support of a text being a divergent process.

In the case of the English workers it seems that they are conscious of the import of the mediation of information. For them the quality of information is dependent on the forms of distribution. The reason for their way of conceptualizing their service information behaviour lies in the concept of coherence. This implies that attention is paid to the way in which various functions of the information system interact with their working environment. The concept of consciousness, especially self-consciousness, has been studied by Sperry (1983). He defines consciousness as the emergence of a unity of mental experience in humans. This unity, in the case of the US workers, centers around the individual's responsibility at his working place. Every person is seen to have responsibility for his actions, i.e., becoming informed or having access to the latest development within his field. It is noteworthy that the US workers contrast favourably with the English in that they put a heavy stress on worthiness. This moral point of view places the US workers in an advantageous position, especially when one considers their desire for comprehension.

On this basis it can be stated that the ecological study of consciousness focusses on the problems of everyday life. Intimately connected with such a diagnosis of consciousness is the question of morality, which means the development of a genuine feeling for (1) what is right or wrong, or (2) obedience and punishment. Under certain circumstances, every person who has been employed or appointed needs to act on his own responsibility. This means that he has (or should have) developed a strong conviction about what is right or wrong in the "official morality" (represented by management, labour unions, or government). Such a person has a great advantage in times of great structural change compared to persons who have been "liberated from the necessity to take their responsibility".

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